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CUBES Project Support

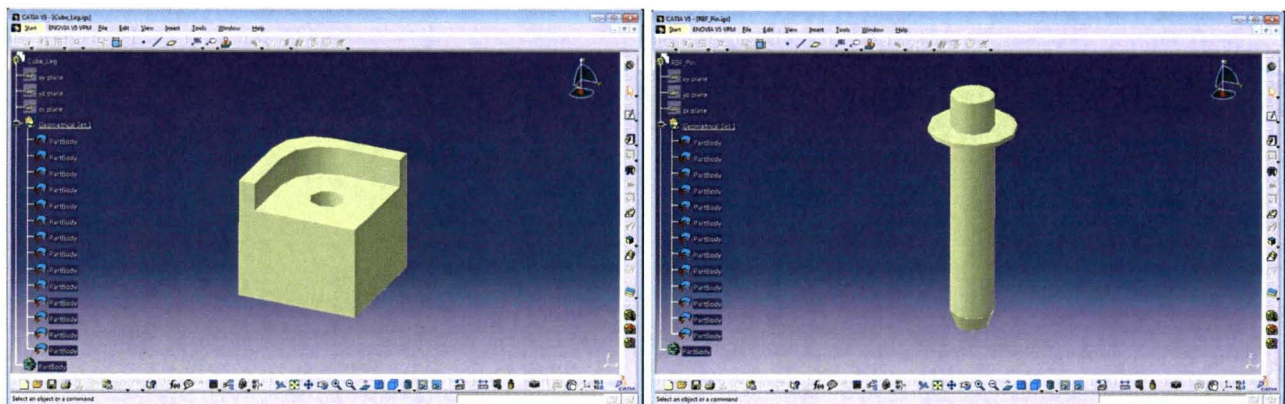
This summer I was the intern project manager for the CUBES pilot project at the Kennedy Space Center (KSC) in the Education Projects Division. CUBES stands for Creating Understanding and Broadening Education through Satellites. The goal of the project is to allow high school students to build a small satellite, or CubeSat. Merritt Island High School (MIHS) was selected to partner with NASA, and California Polytechnic State University (Cal-Poly), to build a CubeSat. The objective of the mission is to collect flight data to better characterize maximum predicted environments inside the CubeSat launcher, Poly-Picosatellite Orbital Deployer (P-POD), while attached to the launch vehicle. The MIHS CubeSat team will apply to the NASA CubeSat Launch Initiative, which provides opportunities for small satellite development teams to secure launch slots on upcoming expendable launch vehicle missions. The MIHS team is working to achieve a test launch, or proof of concept flight, aboard a suborbital launch vehicle in early 2013. I worked on a number of different tasks for the team, from time management, to modeling different parts of the CubeSat, to examining meteorological effects on the P-POD.

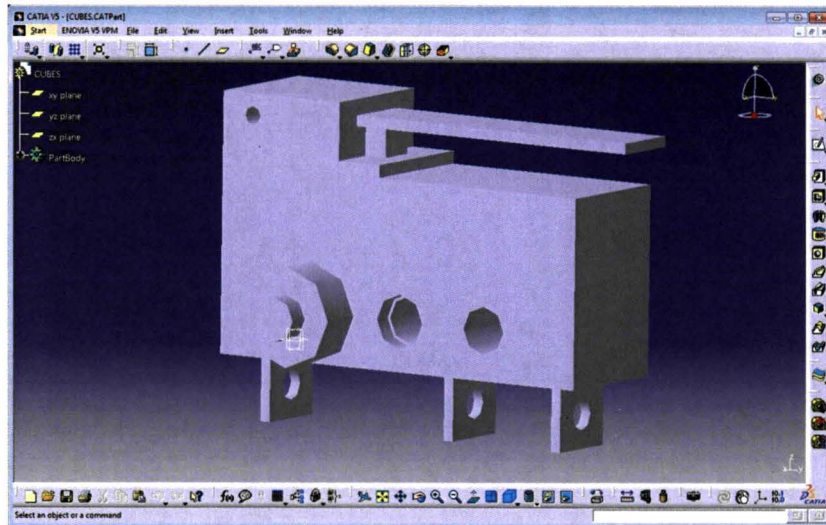
I created a detailed project schedule that includes due dates for different steps of the project, as well as a broad mission schedule to show a quick overview of the major events leading up to the proof of concept flight. The detailed project schedule includes major milestones such as a Mission Concept Review (MCR), Preliminary Design Review (PDR), Critical Design Review (CDR), Systems Interface Review (SIR), and Flight Readiness Review (FRR). These milestones are crucial to the progress of the project. I also created a weekly meeting schedule and calendar for the team to input their weekly agenda and when they will be out of town. The weekly schedule has been helping the team with meeting all of their weekly tasks needed to advance in their project and give regular updates to Cal-Poly. Along with scheduling, I updated multiple inventory spreadsheets. I updated the inventory of all the supplies that were ordered and linked appropriate photographs to most of the items received. Before I got to Kennedy Space Center, my mentor had a few different spreadsheets with all the different supplies listed on them. I was able to condense all of the supplies, up to present, onto one spreadsheet. My mentor also had pictures to go with most of the supplies that were bought. I was then able to link the pictures to

the applicable items in the spreadsheet. I also created a PDR and CDR PowerPoint template for both the MIHS team to use and other high schools in the future to use.

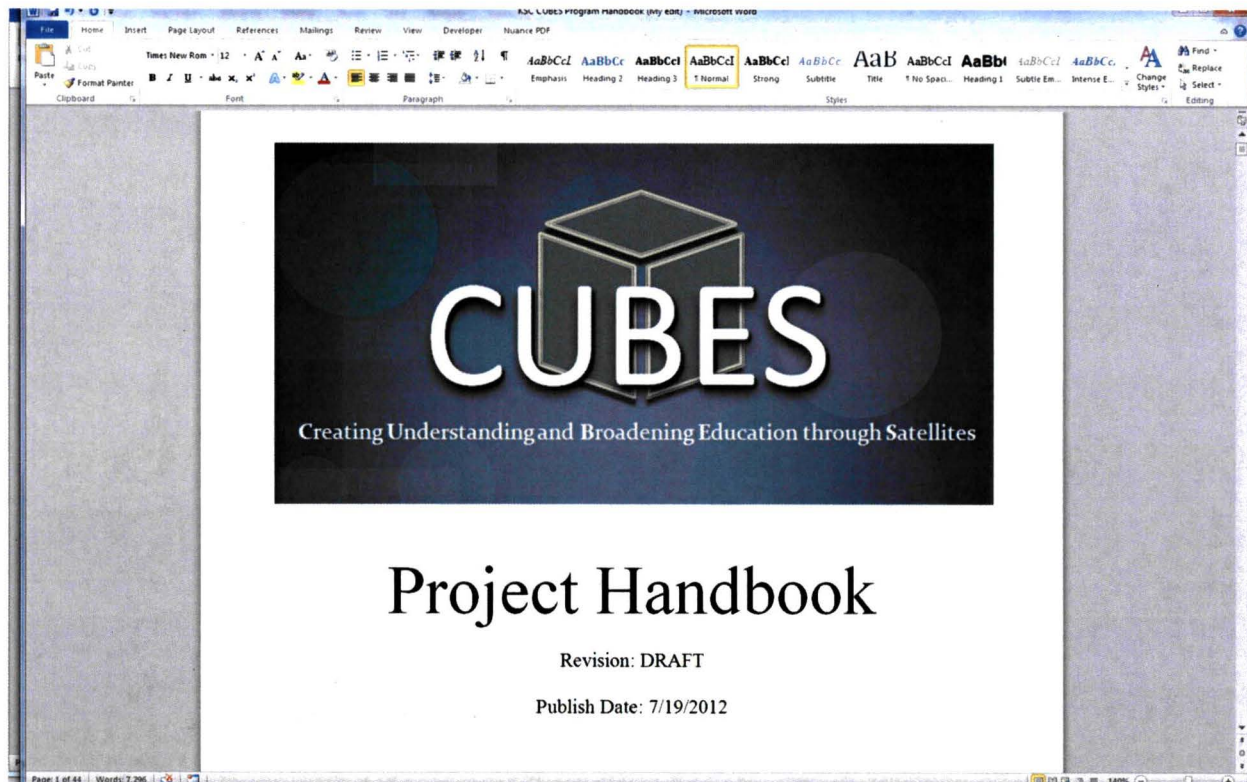
Item No.	Photo	Item Name	Part Number	Product Description	Vendor	Quantity	No. of Pieces	Add. Photos	Add. Photos	Add. Photos	Stored Location
1		Lego Mindstorms Education NXT Base Set	979797	Includes NXT Intelligent Brick, rechargeable lithium DC battery, battery charger, (3) servo motors w/rotation sensors, light sensor, sound sensor, ultrasonic sensor, (2) touch sensors, (3) converter cables, (7) connector cables (2) 0.2M, (2) 0.5M, (4) 0.35M, (3) lamps, USB cable, 437 building elements, plastic storage bin w/sorting trays	Lego Education	1	463	LEGO2			
2		Lego Mindstorms Education NXT Software 2.1	900080	Includes software for programming and data logging w/step-by-step guide and digital user manual	Lego Education	1	2				
3		Renewable Energy Add-On Set	779688	Allows students to experiment with different power sources (solar panel, generator and LEGO energy meter)	Lego Education	1	7	LEGO4			
4		Accelerometer Sensor for Mindstorms NXT	991349	Three axis accelerometer that also measures acceleration to determine position and g forces acting on equipment	Lego	1	1				
5		Bluetooth Dongle	979847	Enables wireless communication between the Lego equipment and the PC. Will aid in students understanding of wireless transmitters and properties thereof	Lego	1	1				
6		Electronics Learning Lab	28-027	Includes owner's manual, learning lab base, sets of ICs, resistors, capacitors, diodes, and transistors, speaker and piezoelectric buzzer element	RadioShack	1	7				
7		Electronic Snap Circuits SC300S w/Computer Interface	SC300S	Provides students with snap-together electrical components to learn the process of constructing electronics	Carl's Electronics	1	7				
8		LabVIEW Student Install Option	779776-01	Software that provides a programming interface between systems within a CubeSat satellite. The software can also interface with Lego Mindstorms kit to aid in understanding of interactions between software and control components	National Instruments	1	7				
9		Microsoft Professional Project 2010	YTT1-84078P	Project Management software for scheduling and tracking, includes disc for installation and a quick start guide	Microsoft	3	6				
10			ECN 1028206	KSC Excess S/N 2934A03103. Includes power cord, (3) HP probe assembly kits, probe w/alligator clip, (3) connectors, 3" wide flat strip connector cord							

Another thing that I was able to do during my great summer internship was to measure and model multiple parts using a 3D Computer Aided Design (CAD) software package, CATIA, for the CubeSat frame. This was one of my favorite parts of the project because I was able to use my knowledge of CATIA to not only reverse engineer different parts on the CubeSat but to also help the high school students understand how to use a 3D CAD program and reverse engineer some of the parts themselves. For example, I modeled the legs, switch, a “Remove Before Flight” pin, and other parts. The class that helped me with this task was Graphical Communications (EGR 120).





Along with modeling the parts, I helped my mentor with the official CUBES project handbook. My mentor and I completely revamped the CUBES project handbook with intent to prepare a useful guide for future high school teams. As the handbook stood before I started my internship, it was hard to understand and know what was going on without reading the “NASA Systems Engineering Handbook.” The main audience that reads the handbook is high school students and their teachers, not NASA employees. With that said, one could see the difficulty Merritt Island High School students and teachers had when they first read the handbook. After a few meetings and a couple of hours, my mentor and I got the handbook to a level that the students would be able to understand.



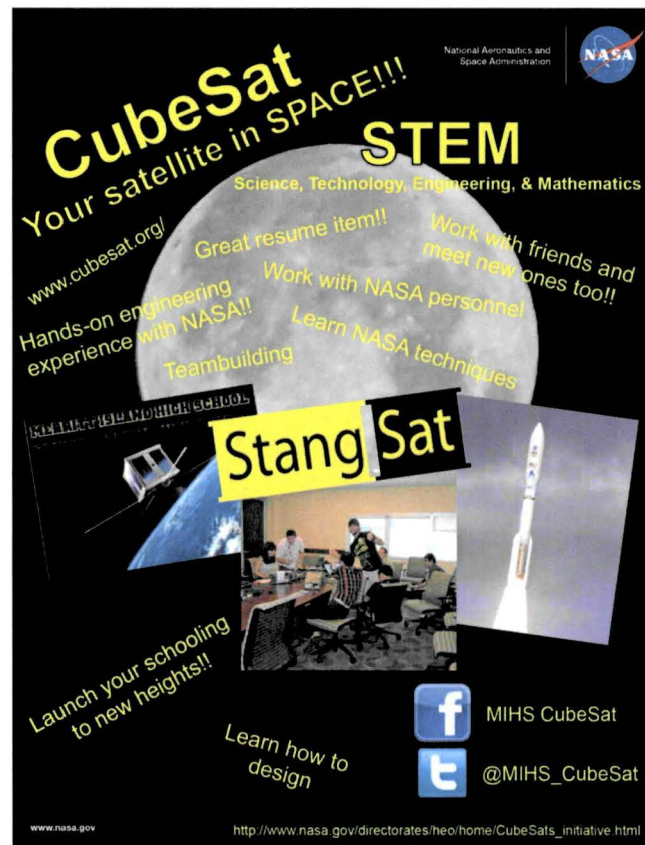
Besides the handbook, I needed to help the student project manager with a large task, to set up and publish a public website. I helped the student project manager with understanding HyperText Markup Language (HTML) coding. I was able to do this, because I have a background in writing in HTML for Ebay items. After I helped with that, I helped the other students with updating and understanding how and why they need to keep their website up to date.

Another task that I was asked to do was to figure out how to calculate the Barometric (atmospheric) pressures at different altitudes. I ran meteorological tests to see how the CubeSat, P-POD, and instrumentation would react at certain atmospheric pressures and altitudes. This was my other favorite part of my project, because I was able to combine most of my skills that I learned in my meteorology classes, such as Thermodynamics of the Atmosphere, Aviation Weather, and Weather Information Systems (WX 353, 301, 270). While I worked on the spreadsheet, I ran into a few problems with the calculations. I consulted with one of the employees in the KSC Weather Office and asked him if he had any ideas in how I could troubleshoot my spreadsheet data. He then contacted a few Air Force employees at the Cape Canaveral Air Force Station (CCAFS) 45th Weather Squadron. He later sent me a Microsoft Word document containing all the equations and explanations of the equations so I could use them in my spreadsheet. After a few days of working on the equations, and consulting him to ensure the accuracy of my process and results, I got the spreadsheet to be accurate within two (2) millibars, or hectopascals, or less.

	Pressure (mb)	Geometric (m)	Temp (K)	Vapor Press (mb)	Geo. Hgt (m)	Virt. Temp (K)	Mean Virt. Temp (K)	Mix Ratio (g/kg)	Mix Ratio (g/g)	RH (%)	RH (dem.)	Temp. (°C)	Dew Pt. (°C)
1	1017.00	0	294.75	26.176	8.99	297.67	297.67	16.26	0.01626	100	1	21.6	21.6
2	1006.91	80	297.15	30.066	79.88	300.58	299.13	18.92	0.01892	99	0.99	24	23.9
3	998.91	160	297.55	28.878	159.77	300.87	300.78	18.86	0.01886	96	0.96	24.4	23.7
4	994.03	213	297.35	27.055	212.69	300.44	300.71	17.06	0.01706	88	0.88	24.2	22
5	983.80	305	296.65	27.094	304.55	299.78	300.11	17.32	0.01732	92	0.92	23.5	22.1
6	979.32	346	296.35	27.175	345.48	299.50	299.64	17.44	0.01744	94	0.94	23.2	22.1
7	952.43	591	295.35	21.467	590.10	297.91	298.70	14.19	0.01419	79	0.79	22.2	18.4
8	950.46	610	295.25	21.334	609.07	297.79	297.85	14.13	0.01413	79	0.79	22.1	18.3
9	925.69	841	293.75	19.669	839.68	296.14	296.97	13.35	0.01335	80	0.8	20.6	17
10	918.04	934	293.45	19.302	912.56	295.80	295.97	13.15	0.01315	80	0.8	20.3	16.6
11	906.88	1021	292.95	18.469	1019.37	295.25	295.53	12.86	0.01286	79	0.79	19.8	16.1
12	901.02	1078	292.55	18.603	1076.27	295.00	295.12	13.73	0.01373	86	0.86	19.4	17
13	886.54	1219	291.55	19.037	1217.01	293.97	294.48	13.6	0.0136	89	0.89	18.4	16.6
14	859.23	1489	289.75	18.103	1486.51	292.11	293.04	13.33	0.01333	95	0.95	16.6	15.8
15	851.33	1569	289.35	17.269	1566.36	291.62	291.86	12.86	0.01286	93	0.93	16.2	15.1
16	845.47	1629	289.15	16.130	1626.24	291.28	291.45	12.05	0.01205	88	0.88	15	14
17	825.97	1829	287.85	15.662	1825.85	289.95	290.61	11.98	0.01198	93	0.93	14.7	13.6
18	814.67	1947	287.15	15.442	1943.61	289.24	289.60	11.94	0.01194	96	0.96	14	13.3
19	808.73	2010	286.95	13.811	2006.48	288.83	289.04	10.74	0.01074	87	0.87	13.8	11.6
20	803.87	2062	286.75	15.040	2058.37	288.81	288.82	11.79	0.01179	96	0.96	13.6	13.9
21	797.15	2134	286.55	12.833	2130.22	288.34	288.57	10.22	0.01022	83	0.83	13.4	10.7
22	794.97	2158	286.55	12.214	2154.17	288.25	288.30	9.75	0.00975	79	0.79	13.4	9.6
23	773.08	2395	286.15	11.143	2390.66	287.79	287.99	9.05	0.00905	74	0.74	13	8.6
24	769.23	2438	285.85	10.923	2433.56	287.41	287.57	8.95	0.00895	74	0.74	12.7	8.2
25	741.89	2743	283.55	9.745	2737.88	284.99	285.20	8.31	0.00831	77	0.77	10.4	6.6
26	739.32	2773	283.35	9.614	2767.81	284.78	284.88	8.25	0.00825	77	0.77	10.2	6.4
27	731.38	2864	282.55	10.526	2858.60	284.11	284.44	9.06	0.00906	89	0.89	9.4	7.6
28	716.51	3036	281.55	9.943	3030.19	283.05	283.58	8.75	0.00875	90	0.9	8.4	6.8
29	709.54	3118	281.35	8.609	3111.99	282.66	282.86	7.63	0.00763	79	0.79	8.2	6.7
30	702.64	3200	280.95	8.906	3193.79	282.33	282.49	8.04	0.00804	84	0.84	7.8	5.8
31	684.99	3415	279.95	7.125	3408.26	281.07	281.70	6.57	0.00657	72	0.72	6.0	5.3

Lastly, I designed multiple flyers and brochures for CUBES, Lunabotics, and other projects, to raise awareness and get more students interested and involved in NASA STEM opportunities.

I also made a CUBES flyer specific for Merritt Island High School to get the incoming freshmen interested in the project and a generic one to put in high schools throughout the country. To promote the NASA CubeSat Launch Initiative, I made a general flyer for high schools and universities to get the students interested in designing a CubeSat that could potentially be launched on an upcoming NASA mission as a secondary payload. I will be bringing a few of these flyers to Embry Riddle for the Fall and Spring Terms. I also made a general brochure for the Education Projects Division of the various projects they support. These brochures will be distributed at universities around the country when the Education Projects Division travels to them.



The current state of the main project that I worked on, CUBES, is still in the pilot stage at Kennedy. When I left the internship, the students of MIHS just completed their PDR with plans of doing their CDR in the beginning of December.

Some new skills and knowledge that I gained has been great. I learned how a Preliminary Design Review (PDR) is conducted. I also learned how to put a PDR and CDR template together and learned the Systems Engineering that goes into both of them. I also picked up a few more Excel skills that I did not know before. I learned how to make a database in Microsoft Access and have participants' information automatically updated. I learned how the KSC Weather Office works in collaboration with the CCAFS 45th Weather Squadron to issue what KSC calls a Phase 1 lightning watch and Phase 2 lightning warning. I also learned how the different organizations work together to make a project come together. I feel that my educational background at ERAU truly helped me learn how the work atmosphere operates. Working with

both high school students and KSC employees, I feel even stronger about working at NASA, especially at NASA KSC. I feel that my dream of working at Kennedy has come true.

While the last ten weeks went by very fast, I was able to make a lot of decisions on my own, as well as proposing solutions and taking some direction with tasks I wasn't 100% sure about. My mentor was very supportive with all the work that I completed. I would say I was under about 50% to 70% control of my mentor. She allowed and encouraged me to take some of the tasks at hand and just go with it, but allowing me to ask as many questions as I needed throughout the duration of the task.

In closing, I truly learned a great deal this summer. I really wish I could stay just one week more. All the different tasks that I worked on both strengthened and challenged me, not only educationally, but mentally as well. I felt at home at NASA Kennedy Space Center. As I mentioned above, I feel my dream of working at NASA full time has come true. The Education Projects Division welcomed me with open arms and made me feel at home. I learned a lot about the corporate culture working in the Education Projects Division, such as work ethic and deadlines. The tasks given to me will help my education down the road. I have learned an immense amount of life and work lessons as well. Some were difficult at first, but as time went on those lessons became every day habits. I feel the tasks given to me were everything I expected and didn't expect. I can't emphasize enough how much I learned this summer and that I am truly grateful for this opportunity. My mentor was extremely supportive of me and I know that we will always be in touch with everything CUBES.